OIL SUPPLY STRUCTURE FOR CONTINUOUSLY VARIABLE VALVE TIMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This application claims priority of Korean Application No. 10-2003-0061475, filed on September 3, 2003, the disclosure of which is incorporated fully herein by reference.

FIELD OF THE INVENTION

[002] The present invention relates to an oil supply structure for a continuously variable valve timing apparatus and, more particularly, to an oil supply structure for improving the response of a continuously variable valve timing apparatus.

BACKGROUND OF THE INVENTION

[003] A rotor vane type continuously variable valve timing apparatus compares a rotating phase of a cam shaft with that of a cam shaft sprocket to rotate a cam shaft relative to a cam shaft sprocket to thereby advance or delay the rotating phase of the cam shaft. In other words, when a rotating phase of a cam shaft is to be delayed in comparison with a cam shaft sprocket, the cam shaft is rotated in the opposite rotating direction of the cam shaft sprocket relative to the cam shaft sprocket to delay the rotating phase, and when the rotating phase is to be advanced, the cam shaft is rotated in the same rotating direction as that of the cam shaft sprocket relative to the cam shaft sprocket to advance the rotating phase.

[004] A power source that advances or delays the cam shaft relative to the cam shaft sprocket is oil pressure supplied from an oil pump. When engine revolution is low and oil temperature is high, there are cases where oil pressure becomes low enough to prevent the variable valve timing apparatus from being fully supplied with oil.

[005] When a cam shaft rotates in a direction opposite from that of the cam shaft sprocket, an operational friction of the cam shaft rather becomes conducive to the rotation of the cam shaft, so that a decreased oil pressure does not pose a big problem.

[006] However, there is a drawback in that the response of a continuously variable valve timing apparatus is decreased when oil temperature is increased to result in a decrease in viscosity and engine revolution is decreased to reduce the output pressure of an oil pump although a cam shaft should overcome an operational friction for rotation and a high oil pressure is needed during a control of an advanced angle.

SUMMARY OF THE INVENTION

[007] The present invention provides an oil supply structure for a continuously variable valve timing apparatus adapted to automatically increase oil pressure supplied to the continuously variable valve timing apparatus when oil temperature rises, thereby enabling the continuously variable valve timing apparatus to provide a reliable response over an entire operating range of an engine.

[008] In accordance with a preferred embodiment of the present invention, the oil supply structure for a continuously variable valve timing apparatus comprises a plurality of bimetal blocks that are disposed at an oil supply pipe between an oil pump and a continuously variable valve timing apparatus and are changed in shapes thereof by an increased oil pressure to thereby reduce a cross-sectional area of the oil supply pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

[009] For a better understanding of the nature and objects of the present invention, reference should be made to the following detailed description with the accompanying drawings, in which:

[0010] FIG. 1 is a schematic constitutional drawing for illustrating an oil supply structure of a continuously variable valve timing apparatus according to an embodiment of the present invention;

[0011] FIG. 2 is a cross-sectional view for illustrating an installed state of bimetal blocks in the oil supply pipe of FIG. 1;

[0012] FIG. 3 is a schematic drawing for illustrating a reduced state of a cross-section of an oil supply pipe as compared with that of FIG. 2; and

[0013] FIG. 4 is a schematic view of the installed state of bimetal blocks in FIG. 3 as seen from a lateral surface.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] A preferred embodiment of the present invention will now be described in detail with reference to the annexed drawings, where the present embodiment is not limiting the scope of the present invention but is given only as an illustrative purpose.

[0015] Referring to FIG. 1, an oil supply structure for a continuously variable valve timing apparatus according to a preferred embodiment of the present invention includes a rotor vane type actuator 7 mounted between a cam shaft sprocket 3 and a cam shaft 5 to enable a rotation of the cam shaft 5 relative to the cam shaft sprocket 3. Sprocket 3 is connected to a crankshaft 1 by a belt or chain. An oil control valve 15 is also disposed for receiving oil pumped by an oil pump 11 from an oil pan 9 via an oil supply pipe 13 and supplying the oil to the variable valve timing actuator 7 by adjusting an oil passage.

[0016] The oil control valve 15 is controlled by an electric signal provided from a controller 17 for receiving signals of various sensors and controlling advanced angles and delayed angles of the valve. The oil supply pipe 13 is equipped with a filter 19 for filtering oil supplied to the variable valve timing apparatus.

[0017] Furthermore, as shown in the drawing with an enlarged cross-sectional view of the structure, the oil supply pipe 13 is mounted with a plurality of bimetal blocks 21 that are disposed between the oil pump 11 and the continuously variable valve timing apparatus. Bimetal blocks 21 change to shape in response to an increased oil temperature to thereby reduce the cross section of the oil supply pipe 13.

[0018] The bimetal blocks 21 are disposed at an inner side of the oil supply pipe 13 with a metal having a smaller thermal expansion coefficient mounted at an outer side of the oil supply pipe 13 and with a metal of larger thermal expansion coefficient such that when temperature rises, a free end, being changed in shape thereof, is moved into the inner side of the oil supply pipe 13 (See FIG. 4).

[0019] Preferably, four bimetal blocks are arranged inside the oil supply pipe 13, each in an equal interval therebetween along a circumferential direction. The free end of the bimetal blocks is made to change toward an inner side of the oil supply pipe 13, where the free end is changed in shape thereof in a high temperature region out of temperature ranges of the oil flowing in the oil supply pipe 13.

[0020] Next, the operation of the oil supply structure in the continuously variable valve timing apparatus thus constructed will be described.

[0021] The bimetal blocks 21 do not change in shape toward the inner side of the oil supply pipe 13 in a relatively low temperature region among temperature ranges in which the temperature of oil flowing in the oil supply pipe 13 can be changed.

[0022] As a result, oil flows in the oil supply pipe 13 under conventional pressure, such that an appropriate level of oil pressure can be supplied to the oil control valve 15 and the continuously variable valve timing actuator 7 in a not-so-low oil viscosity state regardless of an engine running at a high speed or a low speed, thereby enabling the continuously variable valve timing apparatus in a stable manner.

[0023] The bimetal blocks 21 change in shape in a temperature region where oil flowing in the oil supply pipe 13 is increased in temperature sufficient to reduce the viscosity, and as the bimetal blocks 21 approache an inner side of the oil supply pipe 13, the cross section of the oil supply pipe 13 is decreased.

[0024] Consequently, the oil flowing in the oil supply pipe 13 with a reduced cross section rises in pressure, and the oil pressure thus increased can be stably supplied in an appropriate pressure level necessary for operation of the continuously variable valve timing apparatus regardless of whether the engine running at a high speed or a low speed range.

[0025] As apparent from the foregoing, there is an advantage in the oil supply structure for a continuously variable valve timing apparatus thus described according to the embodiment of the present invention in that a plurality of bimetal blocks change in shape due to oil temperature in an oil supply pipe, whereby, when an oil temperature rises, oil pressure supplied to the variable valve timing apparatus is automatically increased, thereby providing the variable valve timing apparatus with a reliable response over an entire operating range.